

CLAIMS

1. A mass spectrometer including,  
a source for producing particles including ions representative of chemical  
5 elements in a sample together with neutral particles and photons,  
an ion optics system contained in a first vacuum region for receiving  
particles from the source, the ion optics system including  
at least one first electrode for establishing an electrostatic field for  
directing a beam of said ions in a first direction from the source and at  
10 least one second electrode for establishing an electrostatic field for  
diverting the beam of ions from the first direction through an angle  
whereby neutral particles and photons emanating from the source  
continue in the first direction and are separated from the beam of ions,  
a quadrupole mass analyser arrangement contained in a second  
15 vacuum region and including  
a set of quadrupole fringe electrodes for receiving the beam of ions, and  
a linear quadrupole mass analyser for receiving ions directly from the set  
of quadrupole fringe electrodes, and  
an ion detector also contained in the second vacuum region for receiving  
20 ions from the linear quadrupole mass analyser,  
wherein the set of quadrupole fringe electrodes are configured to divert  
the ions prior to their passage into the linear quadrupole mass analyser and to  
shield the linear quadrupole mass analyser entrance.
- 25 2. A mass spectrometer as claimed in claim 1 wherein the at least one  
second electrode is for establishing an electrostatic field for diverting the beam  
of ions from the first direction through an angle and in a second direction, and  
the set of quadrupole fringe electrodes of the quadrupole mass analyser  
arrangement receive the beam of ions in the second direction and shield the  
30 linear quadrupole mass analyser entrance as viewed in the second direction.
3. A mass spectrometer as claimed in claim 1 or claim 2 wherein the ion  
optics system includes a first set of electrodes for establishing the electrostatic  
field for directing the beam of ions in the first direction, and a second set of

electrodes for establishing the electrostatic field for diverting the beam of ions from the first direction through said angle.

4. A mass spectrometer as claimed in claim 2 wherein at least one or more  
5 electrodes of the ion optics system are for establishing a reflecting electrostatic field for diverting the beam of ions from the first direction through said angle and in the second direction.
5. A mass spectrometer as claimed in any one of claims 1 to 4 wherein the  
10 electrodes of the set of quadrupole fringe electrodes are elongate and curved to thereby define a curved path to divert the ions prior to their passage into the linear quadrupole mass analyser.
6. A mass spectrometer as claimed in claim 5 wherein the electrodes of the  
15 set of quadrupole fringe electrodes are curved such that the ions exit the set of quadrupole fringe electrodes generally in the same direction as they enter the set of quadrupole fringe electrodes, whereby an entrance end and an exit end of the set of quadrupole fringe electrodes are substantially parallel but not co-  
linear.  
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7. A mass spectrometer as claimed in claim 5 wherein the electrodes of the  
set of quadrupole fringe electrodes are doubly curved such that the ions exit the set of quadrupole fringe electrodes generally in the same direction as they enter, whereby an entrance end and an exit end of the set of quadrupole fringe  
25 electrodes are substantially parallel and co-linear.
8. A mass spectrometer as claimed in claim 5 wherein the electrodes of the  
set of quadrupole fringe electrodes are curved such that the ions exit the set of quadrupole fringe electrodes in a direction generally at 90° to the direction in  
30 which they enter.
9. A mass spectrometer as claimed in any one of claims 1 to 4 wherein the  
electrodes of the set of quadrupole fringe electrodes are elongate and straight, and are tilted relative to an entry direction for the ions into the set of quadrupole

fringe electrodes to thereby divert the ions from that direction prior to their passage into the liner quadrupole mass analyser.

10. A mass spectrometer as claimed in any one of claims 1 to 9 wherein the set of quadrupole fringe electrodes are configured such that as viewed in an entry direction for the ions into the set of quadrupole fringe electrodes, the electrodes of the set at least cover and thereby shield the linear quadrupole mass analyser entrance and thereby also shield the detector.

11. A mass spectrometer as claimed in any one of claims 1 to 10 wherein the angle through which the beam of ions is diverted from the first direction is at least  $10^{\circ}$ .

12. A mass spectrometer as claimed in claim 2 wherein the angle between the first direction and the second direction is substantial, being greater than  $10^{\circ}$ .

13. A mass spectrometer as claimed in claim 12 wherein the substantial angle is about  $90^{\circ}$ .

14. A mass spectrometer as claimed in any one of claims 1 to 13 wherein the source for producing particles including ions representative of chemical elements in a sample together with neutral particles and photons is an inductively coupled plasma source.